

# PATENT SPECIFICATION

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## (54) PROPULSION OF MOTOR VEHICLES

- (71) We, ARCHIE HENRY BLUE and ROSS DERISLEY WOOD, of 11 Clos du Petit Bois, Rue Cauchez, St. Martin's Guernsey, The Channel Islands, both British subjects, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—
- This invention relates to the propulsion of motor vehicles.
- At present, combustion-engined motor vehicles are driven by means of petroleum derivatives. This leads to severe pollution and it is anticipated that reserves of suitable fuels will shortly be exhausted. An object of the present invention is to provide a vehicle propulsion system which is free from pollution and uses materials which are in substantially unlimited supply.
- The present invention resides in a motor vehicle driven by a hydrogen-burning engine and including an electrolytic cell for the electrolysis of water to produce gaseous hydrogen and oxygen, an electrical storage battery for supplying to the cell electrical power for effecting the said electrolysis, and means for collecting hydrogen gas produced in the cell and supplying the hydrogen to the said engine for combustion.
- The hydrogen produced from the water is burned in the engine, producing energy to drive the engine, and the product of combustion is water which can be discharged to the atmosphere, causing effectively no pollution. Furthermore, the raw material, water, is in substantially unlimited supply.
- The heat of combustion may be used, e.g., to generate steam which in turn drives a turbine or reciprocating engine. However, the engine is preferably an internal combustion engine and we have found that the hydrogen produced can be burned directly in a conventional motor car piston engine with very little modification of the engine.
- The oxygen required for combustion of the hydrogen may be obtained from the surrounding atmosphere, as in a conventional motor car engine. Alternatively, the engine may burn the hydrogen with the oxygen also produced in the electrolytic cell. The latter arrangement has the substantial advantage that the hydrogen and oxygen gases produced in the cell do not have to be separated, the product of the cell being a combustible mixture of hydrogen and oxygen which can be supplied to the engine for combustion. In a further possible arrangement, the hydrogen and oxygen produced in the cell may be separated and fed separately to the engine.
- It is desirable to dry the hydrogen, or the hydrogen and oxygen, supplied to the engine. Drying can be effected by drying means connected between the cell and the engine. Alternatively, means may be provided for admitting air to a space between the electrodes of the cell, this air serving to collect and dry the oxygen and hydrogen gases produced at the electrodes; the resulting mixture of air, oxygen and hydrogen is supplied to the engine for combustion therein.
- The electrolytic cell preferably comprises electrodes of pure aluminium only.
- The invention will be further described with reference to the drawings accompanying the provisional specification, in which:
- Figure 1 shows in section an electrolytic cell; and
- Figure 2 shows the general arrangement of the gas-producing apparatus in a vehicle embodying the invention.
- The drawings show a gas producer comprising a container 2 of plastics or glass in which is suspended a set of aluminium electrode plates 3. In use, the container contains an aqueous electrolyte, preferably salt-free water to which a small amount of sulphuric acid or caustic soda has been added.
- The aluminium plates are electrically insulated from each other by means of separators 4. A first set of alternate plates is connected to a battery terminal 12a and the other plates are connected to a battery terminal 12b. These terminals, at the top of

the container, are connected to a 12 volt d.c. battery. An electrical heating element 16 connected in parallel with the electrode plates may be provided in the container to heat the electrolyte and increase the rate of production of gas.

In operation, the current supplied by the battery to the electrode plates generates hydrogen gas only. No oxygen is produced. The hydrogen accumulates in the container in a space provided above the water level 5. The top of the container is provided with a gas outlet.

As shown in figure 2, the gas outlet is connected to a gas storage tank 7, by way of a small electrically driven pump 6, energized for example from the battery.

The storage tank 7 is provided with a pressure gauge 10, a safety valve 9, a non-return inlet valve 15, and a gas outlet pipe 14 provided with a shut-off valve 11.

The gas outlet pipe 14 is connected to the inlet manifold of an internal combustion engine of a vehicle, in which the hydrogen is burned to drive the vehicle. Since the hydrogen used as fuel for the engine is gaseous, there is no need for a carburetor. A throttle valve is however provided for controlling the flow of hydrogen, this valve being actuated by an accelerator control pedal of the vehicle. The exhaust from the engine consists of water vapor. The engine itself is substantially of conventional petrol-engine construction.

The gas tank 7 can be omitted, the gas being fed direct from the drier to the engine manifold. The provision of a gas storage tank will of course facilitate starting since fuel will be available immediately whereas in the absence of such a reserve of fuel it will be necessary to run the electrolytic cell for a short while before the engine can be started. Starting can be effected by means of a starter motor driven from the battery in conventional fashion.

The vehicle will be provided with a conventional electrical generator to provide electrical power while the engine is running, which generator can be used to recharge the battery.

The electrolytic cell requires to be topped up with water and preferably there is provided a small pump for feeding water to the cell from a storage tank on the vehicle; alternatively, the cell itself may be made sufficiently large to provide a useful range for the vehicle before topping-up is necessary. In an experimental vehicle using a cell substantially as described to supply hydrogen to a conventional motor car engine, the cell capacity was one gallon of water containing approximately one ounce of caustic soda, with pure aluminium electrodes energized by means of a 12 volt motor car battery. The range of the vehicle

was approximately 60 miles per pint of water and it was found that the cell would continue to produce hydrogen gas as long as the electrode plates were immersed in one pint of water. The range was therefore over 400 miles, but it was found better to top up the cell after approximately 100 miles. In this vehicle, the drying of the hydrogen gas was effected by means of a fan blowing air through the gas, instead of by the calcium chloride dryer described above. The vehicle reached a speed of 55 miles per hour and it is believed that a substantially higher speed could have been attained.

A further method of drying the gases produced in the cell is to feed air into a space between the electrodes. This air collects and dries the gases forming on the electrodes plates, and the resulting air and gas mixture can be fed to the engine.

In a possible alternative form of cell, one electrode has a conical recess and the other is a cone or rod disposed in the recess. The recess may be provided with a gas outlet at its apex. For the production of hydrogen gas, the first electrode consists of iron powder pressed to solid form and the other electrode is zinc or other non-active metal. For the production of oxygen, the first electrode is made of a compressed paste of zinc and copper particles, and the other electrode is made of compressed iron powder. In each case, the positive terminal is connected to the first electrode.

#### WHAT WE CLAIM IS:—

1. A motor vehicle driven by a hydrogen-burning engine and including an electrolytic cell for the electrolysis of water to produce gaseous hydrogen and oxygen, an electrical storage battery for supplying to the cell electrical power for effecting the said electrolysis, and means for collecting hydrogen gas produced in the cell and supplying the hydrogen to the said engine for combustion.

2. A motor vehicle as claimed in claim 1 wherein the engine is an internal combustion engine.

3. A motor vehicle as claimed in claim 1 or 2 wherein the oxygen produced in the cell is supplied to the engine for combustion of the hydrogen.

4. A motor vehicle as claimed in any of claims 1 to 3 in which the cell is arranged to supply a mixture of the oxygen and hydrogen produced therein to the engine for combustion.

5. A motor vehicle as claimed in claim 4 in which means are provided for admitting air to the cell thereby to collect and dry the oxygen and hydrogen gases produced at the electrodes, and the mixture of air and oxygen and hydrogen thus produced is supplied to the engine for combustion.

6. A motor vehicle as claimed in any of

- claims 1 to 4 including drying means connected between the cell and the engine for drying the gas or gases supplied to the engine.
- 5 7. A motor vehicle as claimed in any of claims 1 to 6 including a gas-storage tank connected between the cell and the engine.
8. A motor vehicle as claimed in any of claims 1 to 7 wherein the cell comprises a container for an aqueous electrolyte, and
- 10 aluminium electrodes in the cell.
9. A motor vehicle as claimed in any of claims 1 to 8 including a pump arranged to pump the hydrogen gas from the cell.
- 15 10. A motor vehicle as claimed in any preceding claim including an electrical generator driven by the engine and connected to the battery to recharge the latter.
11. A motor vehicle as claimed in any preceding claim having an electrolytic gas-producing system substantially as herein described with reference to the drawings accompanying the Provisional Specification.
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Chartered Patent Agents  
57-58 Lincoln's Inn Fields,  
London WC2A 3LS  
Agents for the Applicants.

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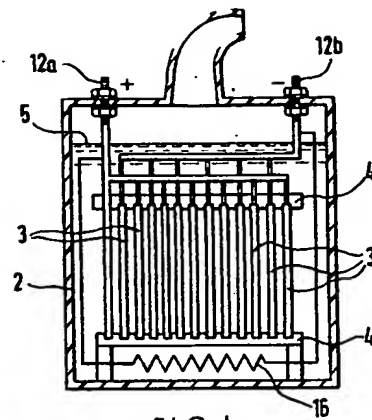


FIG. 1.

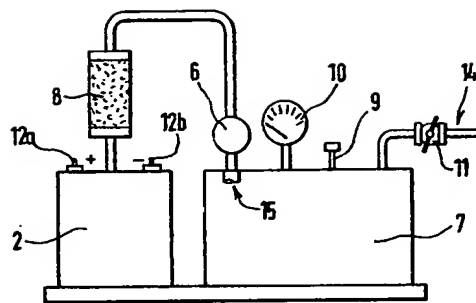


FIG. 2.